AMENDMENTS TO THE SPECIFICATION

In the Abstract of the Disclosure: (Place a replacement or new abstract on a separate sheet)

~~[0021]~~ [0017] The ~~fuzzy audio~~ wireless digital audio music system may utilize a battery powered ~~BLUETOOTH compliant~~ transmitter to transmit a coded digital ~~BLUETOOTH communication~~ signal from an existing ~~non-BLUETOOTH~~ analog headphone jack of a music audio player device or source to a battery powered headphone receiver without the use of wires. A battery powered ~~BLUETOOTH compliant~~ digital transmitter may include a headphone plug in communication with a standard analog headphone jack on ~~a~~ an audio source, such as, laptop and desktop computers, portable compact disc players, portable MP3 players, portable cassette players, etc. The battery powered ~~BLUETOOTH compliant~~ transmitter adds a unique user code ~~as defined in the BLUETOOTH standard~~ and transmits it to the battery powered ~~BLUETOOTH compliant~~ receiver headphones where a fuzzy logic detection system may be used to enhance decoding performance. The ~~BLUETOOTH communication FAWM~~ wireless digital audio system will allow private listening without interference from other users, and without the inconvenience of wires.

In the Specifications:

Please replace the paragraphs and the beginning of the specification with the following rewritten paragraphs and beginning:

~~FUZZY AUDIO~~ WIRELESS DIGITAL AUDIO MUSIC SYSTEM

This is a continuation-in-part of application Serial No. 10/027,391 which patent application is pending.

BACKGROUND OF THE INVENTION

[0001] This invention relates to music audio player devices and more particularly to systems that include headphone listening devices. The new audio music system uses an existing ~~non-BLUETOOTH~~ headphone jack (i.e., this is the standard analog headphone jack that connects to wired headphones) of a music audio player (i.e., portable CD player, portable cassette player, portable A.M./F.M. radio, laptop/desktop computer, portable MP3 player, and the like) to connect a

battery powered ~~BLUETOOTH compliant~~ transmitter for digital wireless transmission of a ~~BLUETOOTH communication~~ signal to a set of battery powered ~~BLUETOOTH compliant~~ receiver headphones. ~~BLUETOOTH is a worldwide wireless standard. Detailed Information regarding the standard is available on the web site www.bluetooth.com.~~

[0002] Use of music audio headphones with music audio player devices such as portable CD players, portable cassette players, portable A.M./F.M. radios, laptop/desktop computer, portable MP3 players and the like, have been in use for many years. These systems ~~usually~~ incorporate an audio source having ~~a~~ an analog ~~non-BLUETOOTH~~ headphone jack to which headphones may be connected by wire.

[0003] There are also known ~~non-portable~~ wireless headphones that may receive ~~infrared (IR)~~ A.M. and F.M. radio transmissions. However, ~~these systems operate with a narrow beam width that requires a point-and-shoot style for reception~~. they do not allow use of a simple plug in (i.e., plug in to the existing analog audio headphone jack) battery powered ~~BLUETOOTH compliant~~ transmitter for connection to any music audio player device jack, such as the above mentioned music audio player devices, for coded digital wireless transmission and reception by ~~BLUETOOTH compliant~~ headphones of audio music for private listening to multiple users occupying the same space, without the use of wires. Existing audio systems make use of electrical wire connections between the audio source and the headphones to accomplish private listening to multiple users.

[0004] There is a need for a battery powered simple connection system for existing music audio player devices (i.e., the previously mentioned music devices), to allow coded digital wireless transmission (using a battery powered ~~BLUETOOTH compliant~~ transmitter) to a headphone receiver (using battery powered ~~BLUETOOTH compliant~~ receiver headphones) that accomplishes private listening to multiple users occupying the same space without the use of wires.

SUMMARY OF THE INVENTION

[0005] The present invention is directed to ~~FAWM (Fuzzy Audio Wireless Music) systems~~ a wireless digital audio music system for coded digital transmission~~, per the BLUETOOTH standard,~~ of an analog audio signal from any music audio player device with an ~~non-BLUETOOTH~~ analog headphone jack to a receiver headphone~~, which adheres to the BLUETOOTH standard~~. Fuzzy logic technology may be utilized by the ~~FAWM~~ wireless digital audio music system to enhance bit detection. A battery powered ~~BLUETOOTH compliant~~ transmitter may include a headphone plug in communication with any of the previously mentioned music audio sources. For reception, a battery

powered ~~BLUETOOTH compliant~~ headphone receiver may apply fuzzy logic to enhance user code bit detection. Fuzzy logic detection may be used to enhance user code bit detection during decoding of the ~~BLUETOOTH communication~~ signal. The ~~FAWM~~ wireless digital audio music system will provide private listening without interference from other users and without the use of wires.

[0006] These and other features, aspects and advantages of the present invention will become better understood with reference to the following drawings, description and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] Figure 1 illustrates a schematic diagram representation of the ~~FAWM~~ wireless digital audio music system according to and embodiment of the invention;

Figure 2 illustrates a schematic diagram representation of the ~~FAWM~~ transmitter according to an embodiment of the invention;

Figure 3 illustrates a schematic diagram representation of the ~~FAWM~~ receiver without the use of the fuzzy logic enhancement according to an embodiment of the invention;

Figure ~~2~~ 4 illustrates a schematic diagram representation of the ~~FAWM~~ system with the use of the fuzzy logic enhancement ~~a graph of the high and low bit fuzzy logic if-then part fuzzy set~~ according to an embodiment of the invention.

DETAILED DESCRIPTION

[0008] The following detailed description is the best currently contemplated modes for carrying out the invention. The description is not to be taken in a limiting sense, but is made merely for the purpose of illustrating the general principles of the invention.

[0009] Referring to ~~Figure~~ Figures 1 through 3, a ~~FAWM~~ wireless digital audio music system 10 may include a battery powered ~~BLUETOOTH compliant~~ transmitter 20 connected to a portable music audio player or music audio source 80. The battery powered ~~BLUETOOTH compliant~~ wireless digital audio music transmitter 20 that utilizes ~~a CODEC~~ an analog to digital converter or ADC 32 ~~and BLUETOOTH front end~~ may be connected to the music audio source 80 analog ~~non-BLUETOOTH~~ headphone jack 82 using a headphone plug 22. The battery powered ~~BLUETOOTH~~

~~compliant~~ transmitter 20 may have a transmitting antenna 24 that may be omni-directional for transmitting a spread spectrum modulated signal~~, which adheres to the BLUETOOTH standard,~~ to a receiving antenna 52 of a battery powered ~~BLUETOOTH compliant~~ headphone receiver 50. The battery powered ~~BLUETOOTH compliant~~ receiver 50 may have headphone speakers 54 in headphones 55 for listening to the spread spectrum demodulated and decoded ~~BLUETOOTH~~ communication signal. In the headphone receiver 50, ~~During decoding,~~ fuzzy logic detection may be used to optimize reception of the received user code. ~~increase receiver decoding performance.~~ The ~~FAWM BLUETOOTH compliant~~ transmitter 20 may digitize the audio signal ~~per the BLUETOOTH standard~~ using ~~a CODEC~~ an ADC 32 that may be in communication with an encoder 36. ~~and BLUETOOTH front end~~. This ~~BLUETOOTH compliant~~ digital signal has a throughput of approximately 1.4 Mbps that may be as low as approximately 1.0 Mbps. After digital conversion, the digital signal may be processed by a digital low pass filter 34. To reduce the effects of channel noise, the battery powered ~~BLUETOOTH compliant~~ transmitter 20 may use channel encoding 38. A modulator 48 modulates the digital signal to be transmitted. For further noise immunity, spread spectrum modulation 42 ~~, as defined in the BLUETOOTH standard~~ is utilized. The battery powered ~~BLUETOOTH compliant~~ transmitter 20 may contain a ~~BLUETOOTH compliant~~ code ~~shift register~~ generator 44 ~~(SRG)~~, ~~or the like,~~ that may be used to create a unique user code. The unique user code generated is specifically associated with one ~~FAWM~~ wireless digital audio music system user, and it is the only code recognized by the battery powered ~~FAWM BLUETOOTH compliant~~ headphone receiver 50 operated by a particular user. The radio frequency (RF) spectrum utilized (as taken from the Industrial, Scientific and Medical (ISM) band), may be approximately 2.4 GHz. ~~as defined in the BLUETOOTH standard~~. And the power radiated by the ~~BLUETOOTH compliant~~ transmitter adheres to the ISM ~~ISM BLUETOOTH~~ standard.

[0010] Referring to ~~Figure~~ Figures 1 through 4, the spread spectrum modulated ~~BLUETOOTH compliant~~ signal from transmit antenna 24 may be received by receiving antenna 52 and then spread spectrum demodulated 62 with a receiver code generator 60 that contains the same transmitted unique code ~~per the BLUETOOTH standard~~, in the battery powered ~~BLUETOOTH compliant~~ receiver 50 headphones. The transmitted signal from transmit antenna 24 may be received by receiving antenna 52 and communicated to a wideband bandpass filter (BPF) 64. The received digital signal may be processed by a demodulator 58 (Figure 3). The battery powered ~~BLUETOOTH compliant~~ receiver 50 may utilize fuzzy logic 61 (as best viewed in Figure 4) to optimize the bit detection of the received ~~packet~~ user code.

[0011] Each ~~BLUETOOTH compliant~~ receiver headphone 50 user may be able to listen

(privately) to high fidelity audio music, using any of the audio devices listed previously, without the use of wires, and without interference from any other ~~BLUETOOTH compliant~~ receiver headphone 50 user. The fuzzy logic detection technique 61 that may be used in the ~~FAWM~~ receiver 50 could provide greater user separation through optimizing code division in the ~~BLUETOOTH compliant~~ headphone receiver.

[0012] The battery powered ~~BLUETOOTH compliant~~ transmitter 20 sends the audio music information to the battery powered ~~BLUETOOTH compliant~~ receiver 50 in digital packet format ~~as defined in the BLUETOOTH standard~~. ~~Each packet may consist of, at minimum, a start bit to indicate the beginning of a packet, the unique user code, the digitized audio information and a stop bit to indicate the end of a packet.~~ These packets may flow to create a digital bit stream rate of less than or equal to 1.0 Mbps ~~as defined in the BLUETOOTH standard~~.

[0013] The user code bits in each packet may also be received and detected by a fuzzy logic ~~detector~~ detection 61 system (as an option) in the headset receiver 50 to provide additional receiver ~~decoding~~ performance. For each consecutive packet received, the fuzzy logic ~~detector~~ detection system may compute a conditional density with respect to the context and fuzziness of the user ~~packet~~ code vector, i.e., the received code bits in each packet. ~~The fuzzy logic detection system FAWM BLUETOOTH compliant receiver 50 to accurately detect the assigned user code packet code in the presence of noise, which may include other FAWM users.~~ Fuzziness may describe the ambiguity of the high bit (1)/low bit (0 or -1) bit event in the ~~noisy~~ received user code within the packet. The fuzzy logic detection system 61 may measure the degree to which a high/low bit occurs in the user ~~packet~~ code vector, which produces a low probability of bit error in the presence of noise. The fuzzy logic ~~detector~~ detection system 61 may use a set of if-then rules to map the user code bit inputs to validation outputs. These rules may be developed as if-then statements 61.

[0014] The fuzzy logic detection system 61 in the battery powered ~~BLUETOOTH compliant~~ headphone receiver 50 utilizes the if-then fuzzy set to map the received user code bits into two values; a low (0 or -1) and a high (1). Thus, as the user code bits are received, the "if" rules map the signal bit energy to the fuzzy set low value to some degree and to the fuzzy set high value to some degree. See Figure ~~2~~ 4 schematic block 61. Figure ~~2~~ 4 schematic block 61 shows that -1 equals the maximum low bit energy representation and 1 equals the maximum high bit energy representation. Due to additive noise, the user code bit energy may have some membership to low and high as represented in 61 of Figure ~~2~~ 4. The if-part fuzzy set may determine if each bit in the user code, for every received packet, has a greater membership to a high bit representation or a low bit representation. The more a user code bit energy fits into the high or low representation, the

closer its subsethood, i.e., a measure of the membership degree to which a set may be a subset of another set, may be to one.

~~[0015]~~

~~[0016]~~

~~[0017]~~

~~[0018]~~

~~[0019]~~ [0015] The if-then rule parts that make up the fuzzy logic detection system 61 must be followed by a defuzzifying operation. This operation reduces the aforementioned fuzzy set to a bit energy representation (i.e., -1 or 1) that is received by the transmitted ~~BLUETOOTH standard~~ packet. The fuzzy logic detection system 61 may be used in the battery powered ~~BLUETOOTH compliant~~ headset receiver 50 to enhance overall ~~FAWM~~ system 10 ~~decoding~~ performance.

[0016] A channel decoder 66 may be in communication with the bandpass filter (BPF) 64. A ~~CODEC~~ decoder 68 may be in communication with a digital to analog converter or DAC 70 that may convert the digital signal back to an analog audio music signal. An analog low pass filter 72 may be used to filter the analog audio music signal to pass a signal in the approximate 20 Hz to 20 kHz frequency range and filter other frequencies. The analog audio music signal may then be processed by a power amplifier 74 that may be optimized to for powering headphone speakers 54 to optimize a high quality, low distortion audio music signal for hearing by a user wearing the headphones 55.

~~[0020]~~ [0017] While the invention has been particularly shown and described with respect to the illustrated and preferred embodiments thereof, it will be understood by those skilled in the art that the foregoing and other changes in form and details may be made therein without departing from the spirit and scope of the invention.